Texas State Soil and Water Conservation Board
State Nonpoint Source Grant Program
FY 2018 Workplan 18-50

SUMMARY PAGE			
Title of Project	Texas Bacterial Source Tracking Program (FY18–FY19)		
Project Goals	• Support BST analyses throughout Texas • Further refine Texas *E. coli* BST Library • Evaluate new library independent markers • Provide outreach regarding BST		
Project Tasks	(1) Project Administration; (2) Quality Assurance; (3) BST Analyses; (4); Known Source Fecal Sample Collection; (5) BST Library Refinement and Library Independent Marker Development; (6) Outreach		
Measures of Success	• BST Analyses for Mission River and Aransas River watersheds • Addition of 50 known source fecal samples to BST Library • Evaluation of source-specific, library-independent markers • Outreach through website and delivery of BST informational materials		
Project Type	Implementation ( ); Education ( ); Planning ( ); Assessment (X); Groundwater ( )		
Status of Waterbody on *2014 Texas Integrated Report*	Segment ID 2001 2003 2004	Parameter of Impairment or Concern Bacteria Bacteria Bacteria	Category 5a 5a 5c
Project Location (Statewide or Watershed and County)	Statewide, but with BST support in Bee, Goliad, Refugio, and San Patricio counties		
Key Project Activities	Hire Staff (X); Surface Water Quality Monitoring ( ); Technical Assistance ( ); Education (X); Implementation ( ); BMP Effectiveness Monitoring ( ); Demonstration ( ); Planning ( ); Modeling ( ); Bacterial Source Tracking (X); Other ( )		
2012 Texas NPS Management Program Reference	• Component 1 – LTG Objectives 1, 2, 3, 6 • Component 1 – STG 1C • Components 2, 3, 5		
Project Costs	Federal	$ 370,169	
Project Management	• Texas A&M AgriLife Research, Texas Water Resources Institute • Texas A&M AgriLife Research, Department of Soil and Crop Sciences • The University of Texas Health Science Center at Houston School of Public Health, El Paso Regional Campus		
Project Period	January 1, 2018 – March 31, 2020		

Part I – Applicant Information

Applicant							
Project Lead	Lucas Gregory, Ph.D.						
Title	Senior Research Scientist and Quality Assurance Officer						
Organization	Texas Water Resources Institute						
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Co-Applicant							
Project Lead	Terry Gentry, Ph.D.						
Title	Professor						
Organization	Texas A&M AgriLife Research, Department of Soil and Crop Sciences						
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Co-Applicant							
Project Lead	Kristina D. Mena, MSPH, Ph.D.						
Title	Associate Professor & Interim Regional Dean						
Organization	The University of Texas Health Science Center at Houston School of Public Health, El Paso Regional Campus						
E-mail Address	Kristina.D.Mena@uth.tmc.edu						
Street Address	5130 Gateway East Blvd., MCA 309						
City	El Paso	County	El Paso	State	TX	Zip Code	79905
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Project Partners	
Names	Roles & Responsibilities
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities and ensure coordination of activities with related projects and TCEQ.
Texas A&M AgriLife Research, Texas Water Resources Institute (TWRI)	Project Coordination and Administration, Quality Assurance, Reporting, and Outreach (Tasks 1, 2, and 5).
The University of Texas Health Science Center at Houston School of Public Health, El Paso Regional Campus (UTSPH EP)	Work in conjunction with AgriLife SCSC to perform all work described in Tasks 2-6.
Texas A&M AgriLife Research – Department of Soil and Crop Sciences (AgriLife SCSC)	Work in conjunction with UTSPH EP to perform all work described in Tasks 2-6.

Part II – Project Information

Project Type							
Surface Water	X	Groundwater					
Does the project implement recommendations made in (a) a completed WPP, (b) an adopted TMDL, (c) an approved I-Plan, (d) a Comprehensive Conservation and Management Plan developed under CWA §320, (e) the *Texas Coastal NPS Pollution Control Program*, or (f) the *Texas Groundwater Protection Strategy*?			Yes		No	X	
If yes, identify the document.							
If yes, identify the agency/group that developed and/or approved the document.				Year Developed			

Watershed Information				
Watershed or Aquifer Name(s)	Hydrologic Unit Code (12 Digit)	Segment ID	Category on 2014 IR	Size (Acres)
Aransas River	121004070101-0106; 0201-0206; 0301-0305; 0401-0404	2003 2004	5a 5c	575,213
Mission River	121004060101-0109; 0201-0209; 0301-0307 121004070101-0106; 0201-0206	2001 2002	5a N/A	788,720

Water Quality Impairment

Describe all known causes (i.e., pollutants of concern) and sources (e.g., agricultural, silvicultural) of water quality impairments or concerns from any of the following sources: *2014 Texas Integrated Report*, Clean Rivers Program Basin Summary/Highlights Reports, or other documented sources.

Parameter(s) of Impairment:

2001_01 – Bacteria;

2003_01 – Bacteria;

2004A_01 - Bacteria

Category:

2001_01-5a;

2003_01-5A;

2004A_01-5b

Parameter(s) of Concern:

2002_01 – Bacteria (CN);

2004_02 – Bacteria (CN), Depressed Dissolved Oxygen (CS), Nitrate (CS), Orthophosphorus (CS), Total Phosphorous (CS); 2004A_01 – Depressed Dissolved Oxygen (CN);

2004B_02 – Bacteria (CN), Depressed Dissolved Oxygen (CS).

Pollutant Sources:
2001_01: nonpoint and unknown sources
2003_01: nonpoint, municipal point and unknown sources
2004_02: nonpoint and unknown sources

Project Narrative

Problem/Need Statement

Bacteria are the number one cause of water quality impairment in Texas. Bacterial Source Tracking (BST) is a valuable tool for identifying human and animal sources of fecal pollution to support development of watershed plans, TMDLs, and other strategies for addressing these impairments. Comprehensive BST has been completed by UTSPH EP and AgriLife SCSC in numerous watersheds throughout Texas with support provided by the TSSWCB. As a result of these joint efforts over the last decade, the Texas *E. coli* BST Library (ver. 5-15) currently contains 1,765 *E. coli* isolates obtained from 1,554 different domestic sewage, wildlife, livestock and pet fecal samples. Despite its expansiveness, continued development and refinement of the library to include additional known source isolates from additional Texas watersheds and different animal hosts are needed to further increase its utility. Looking to the future, library independent BST holds much promise. It is already being used to support BST analyses in Texas. However, to improve its ability to address the needs in Texas, further work is needed to develop and evaluate new markers. Finally, continued outreach and technology transfer is needed to expand awareness and understanding of BST, foster dialogue and collaboration, and bring water resource managers up to speed on advances in BST technologies, methodologies, applications and results.

Project Narrative

General Project Description (Include Project Location Map)

Due to the current BST projects and growing interest in BST among state agencies, river authorities, and stakeholder groups across Texas, the statewide BST analytical infrastructure needs to be maintained and advanced appropriately. This not only includes the needed maintenance and repairs of analytical equipment; but also the continued support, training, and retention of skilled personnel. With recent personnel changes at UTSPH EP and TWRI, there is also a near-term need for increased interaction among laboratories to facilitate the transition. To meet the needs of the State, BST analytical capabilities will be maintained at both UTSPH EP and AgriLife SCSC BST laboratories. Financial support will be used to maintain lab personnel at UTSPH EP and AgriLife SCSC, continue refinement and evaluation of the Texas *E. coli* BST library, continue work on marker development and evaluation, and support targeted BST analyses for two watersheds (TBD).

Template-SOPs will be reviewed and updated accordingly to ensure that they are current and up to date with applicable methods, technologies and markers. UTSPH EP and AgriLife SCSC will collaborate to evaluate and refine the Texas *E. coli* BST library. Fingerprint diversity of source-specific *E. coli* isolates will be investigated to help evaluate the strain representativeness of the library. This will allow the project team to identify specific needs for the expansion and refinement of the library. To support library expansion and BST analyses in the Aransas River and Mission River watersheds, approximately 100 known source fecal samples from targeted animal sources will be collected by TWRI and analyzed for *E. coli*.

As funding allows, AgriLife SCSC and UTSPH EP will continue work to evaluate and further develop/refine source-specific bacterial PCR markers. Specifically, efforts will be made to evaluate the addition of library-independent markers to the Texas BST toolbox. Further, TWRI, AgriLife SCSC and UTSPH EP will cooperate with other entities nationwide to ensure that the most up-to-date and accurate BST approaches are implemented in Texas. Library-independent markers continue to be developed and validated. To-date our use of these markers for watershed characterization has primarily been on a presence/absence basis. Recent work in our labs has indicated that multiple markers have potential for quantitative detection of bacteria from different sources. Quantitative detection of markers will allow relative ranking of sources and also provide information needed for potentially linking BST results with Quantitative Microbial Risk Assessment (QMRA) efforts. We plan to continue evaluation of library-independent markers and examine the potential for use of digital PCR (dPCR) to improve quantitative detection. dPCR has the potential to enhance detection by reducing issues with PCR inhibition which are commonly encountered with environmental samples and also increasing the accuracy of detection by eliminating the need for relative calibration using standard curves.

Finally, delivering educational and informational programming regarding BST continues to be a critical need. To this end, TWRI will continue to host and maintain the BST website (http://texasbst.tamu.edu/). The website will be used to disseminate educational materials, project updates, science updates, and other outreach efforts to advance the science and application of BST in Texas and nationally. To provide greater outreach to water resource managers in Texas, the project team will promote the use of and provide resources on BST. As needed to support this, TWRI, UTSPH EP, and AgriLife SCSC will develop additional flyers, one-pagers, tri-folds or other appropriate printed media to 1) discuss the appropriate application of BST in identifying fecal contamination sources and 2) promote the analytical laboratory capability of public BST labs which the State has invested. As appropriate, TWRI will also include information about BST in its publications. Additionally, TWRI, UTSPH EP, and AgriLife SCSC will periodically meet with natural resource agencies to advance the general knowledge and understanding of agency staff on the use of BST in Texas.

Tasks, Objectives and Schedules				
Task 1	Project Administration			
Costs	Federal	$ 33,315		
Objective	To effectively administer, coordinate and monitor all work performed under this project including technical and financial supervision and preparation of status reports.			
Subtask 1.1	TWRI will prepare electronic quarterly progress reports (QPRs) for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of December, March, June and September. QPRs shall be distributed to all Project Partners.			
	Start Date	Month 1	Completion Date	Month 27
Subtask 1.2	TWRI will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.			
	Start Date	Month 1	Completion Date	Month 27
Subtask 1.3	TWRI will host coordination meetings or conference calls, at least quarterly, with Project Partners to discuss project activities, project schedule, communication needs, deliverables, and other requirements. TWRI will develop lists of action items needed following each project coordination meeting and distribute to project personnel.			
	Start Date	Month 1	Completion Date	Month 27
Subtask 1.4	TWRI, with assistance from partners will develop a Final Report that summarizes activities completed and conclusions reached during the project and discusses the extent to which project goals and measures of success have been achieved.			
	Start Date	Month 1	Completion Date	Month 27
Deliverables	• QPRs in electronic format • Reimbursement Forms and necessary documentation in hard copy format • Final Report in electronic and hard copy formats			

Tasks, Objectives and Schedules				
Task 2	Quality Assurance			
Costs	Federal	$6,663		
Objective	To develop data quality objectives (DQOs) and quality assurance/control (QA/QC) activities to ensure data of known and acceptable quality are generated through this project.			
Subtask 2.1	TWRI will develop a QAPP for activities in Task 3-5 consistent with the most recent versions of *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* and the *TSSWCB Environmental Data Quality Management Plan*. All monitoring procedures and methods prescribed in the QAPP shall be consistent with the guidelines detailed in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue (RG-415)* and *Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416)*. [Consistency with Title 30, Chapter 25 of the Texas Administrative Code, *Environmental Testing Laboratory Accreditation and Certification*, which describes Texas' approach to implementing the National Environmental Laboratory Accreditation Conference (NELAC) standards, shall be required where applicable.]			
	Start Date	Month 1	Completion Date	Month 4
Subtask 2.2	TWRI, UTSPH EP and AgriLife SCSC will implement the approved QAPP and submit revisions and amendments as needed.			
	Start Date	Month 4	Completion Date	Month 27
Subtask 2.3	AgriLife SCSC and UTSPH EP will maintain and update the 7 statewide BST template-SOPs for collection of fecal samples for BST, isolation of *E. coli*, archival of *E. coli* isolates, ERIC-PCR, RP, pre-processing of water samples for *Bacteroidales* PCR, and *Bacteroidales* PCR consistent with *EPA Guidance for Preparing Standard Operating Procedures (SOPs) (QA/G-6)* and the *TSSWCB Environmental Data Quality Management Plan* so that they include the most recent advances in BST science, methodologies, markers and technologies.			

	Start Date	Month 1	Completion Date	Month 27
Deliverables	• QAPP approved by TSSWCB and EPA in both electronic and hard copy formats • Approved revisions and amendments to QAPP, as needed • Data of known and acceptable quality as reported through Task 3-5			

Tasks, Objectives and Schedules				
Task 3	BST Analyses			
Costs	$92,542			
Objective	Support BST analyses for the Aransas and Mission River watersheds			
Subtask 3.1	UTSPH EP and AgriLife SCSC will maintain BST analytical equipment (e.g., RiboPrinter) and general laboratory equipment to support BST analyses. This includes securing maintenance contracts, replacement parts, and expendable supplies. AgriLife SCSC will purchase and install laboratory refrigerator for running ERIC gels.			
	Start Date	Month 1	Completion Date	Month 27
Subtask 3.2	UTSPH EP and AgriLife SCSC will retain (or hire) lab personnel, students, and/or Postdoctoral Research Associates to maintain laboratory operating capacities and technical expertise to conduct BST studies across the state.			
	Start Date	Month 1	Completion Date	Month 27
Subtask 3.3	UTSPH EP will perform targeted BST analysis to support the watershed planning efforts in the Aransas River watershed. BST analyses will be performed on monthly samples from 1-2 sites (i.e. 12 months x 1-2 sites = 12-24 total samples) in the Aransas River watershed. Sample collection will be conducted by TWRI with funding provided by TCEQ.			
	Start Date	Month 4	Completion Date	Month 27
Subtask 3.4	AgriLife SCSC will perform targeted BST analysis to support TMDL implementation plan efforts in the Mission River watershed. BST analyses will be performed on monthly samples from 1 site for a total of 12 samples in the Mission River watershed. Samples will be collected by TWRI with funding provided by TCEQ.			
	Start Date	Month 4	Completion Date	Month 27
Deliverables	• BST analyses for Aransas River watershed • BST analyses for Mission River watershed			

Tasks, Objectives and Schedules				
Task 4	Known Source Fecal Sample Collection			
Costs	$19,249			
Objective	To expand the Texas *E. coli* BST Library and support BST analyses in the Aransas River and Mission River watersheds through the collection of approximately 50 known source fecal samples.			
Subtask 4.1	TWRI will work with UTSPH EP and AgriLife SCSC to develop a targeted list of needed species for fecal sample collection and plan for their collection and delivery. This list should primarily fill gaps in the Texas *E. coli* BST Library and provide support for analyses in the Aransas River and Mission River watersheds.			
	Start Date	Month 2	Completion Date	Month 4

Subtask 4.2	TWRI will collect 25 fecal samples from each watershed in accordance with the plan developed in Subtask 3.1 and work closely with UTSPH EP and AgriLife SCSC to coordinate delivery of the samples to the appropriate lab. TWRI will communicate with a select group of organizations, agencies and businesses in each of the 2 targeted watersheds to arrange and resolve any access concerns and gather input to improve geographic targeting of sample collection. Travel plans, scheduling, and routing maps will be prepared prior to deploying the field crew. TWRI will deploy the field crew to collect known source samples from each targeted watershed. TWRI will coordinate closely with UTSPH EP and AgriLife SCSC to ensure sample delivery adheres to established QA/QC procedures. A known source sample data set will be finalized after completion of the field work and submitted to TSSWCB.			
	Start Date	Month 4	Completion Date	Month 27
Deliverables	• Proposed list of needed species recommended for fecal sample collection • MS Excel summary data sheets cataloguing known source samples collected			

Tasks, Objectives and Schedules				
Task 5	BST Library Refinement and Library Independent Marker Development			
Costs	$199,891			
Objective	Evaluate and expand the statewide *E. coli* BST library through the addition of 50 known source fecal samples collected through Task 3. Develop and refine library-independent markers.			
Subtask 5.1	UTSPH EP and AgriLife SCSC will isolate *E. coli* from the approximately 50 known source fecal samples collected through Task 3. Approximately three isolates from each fecal sample (for a total of approximately 150 isolates) will be analyzed using ERIC-PCR for inclusion in the Texas *E. coli* BST Library; based on the ERIC-PCR fingerprint patterns, approximately half of the isolates (75) will be further analyzed using RP for inclusion in the Texas *E. coli* BST Library. UTSPH EP and AgriLife SCSC will equitably split workload.			
	Start Date	Month 4	Completion Date	Month 27
Subtask 5.2	UTSPH EP and AgriLife SCSC will collaborate to evaluate the geographical and temporal stability, composition, average rates of correct classification (accuracy), diversity of source specific isolates, and further development and refinement needs of the Texas *E. coli* BST library, as the library is updated with new known-source isolates.			
	Start Date	Month 4	Completion Date	Month 27
Subtask 5.3	As funding allows, AgriLife SCSC and UTSPH EP will utilize the best available bacterial indicators to evaluate and further develop/refine source-specific bacterial PCR markers using known source fecal material. AgriLife SCSC and UTSPH EP efforts will focus on evaluating additional library-independent PCR markers for the Texas BST toolbox and evaluate the potential for using dPCR for BST.			
	Start Date	Month 4	Completion Date	Month 27
Deliverables	• Highlights of work performed included in QPRs and Final Report			

Tasks, Objectives and Schedules				
Task 6	Outreach			
Costs	$18,509			
Objective	Provide continued outreach regarding BST and its application through improving the statewide knowledge base regarding current BST practices, scientific advances, improvements in the application of BST, and incorporating information from other areas of the nation into the BST approaches utilized in Texas.			
Subtask 6.1	TWRI will host and maintain the http://texasbst.tamu.edu website to disseminate educational materials, project updates, science updates, notify readers about educational opportunities, and other outreach efforts to advance the science and application of BST in Texas and nationally.			
	Start Date	Month 1	Completion Date	Month 27

Subtask 6.2	TWRI, UTSPH EP, and AgriLife SCSC will promote the use of and provide resources on BST. TWRI, UTSPH EP, and AgriLife SCSC will distribute educational brochures developed. As needed, TWRI, UTSPH EP, and AgriLife SCSC will develop additional flyers, one-pagers, tri-folds or other appropriate printed media, that can be used to 1) discuss the appropriate application of BST in identifying fecal contamination sources and 2) promote the analytical laboratory capability of public BST labs which the State has invested. As appropriate, TWRI will include information about BST in general, and this project specifically, in the *txH2O* magazine and *Conservation Matters* e-mail newsletter. Finally, TWRI, UTSPH EP, and AgriLife SCSC will periodically meet with natural resource agencies, public and private laboratories, and other researchers/academia to advance the general knowledge and understanding of BST and appropriate methodologies and SOPs for use of BST in Texas.			
	Start Date	Month 1	Completion Date	Month 27
Deliverables	• Summaries of outreach efforts included in QPRs and Final Report			

Project Goals (Expand from Summary Page)

Support BST analyses across the State through (1) continued personnel support and operation and maintenance of analytical infrastructure at public BST laboratories; (2) continued development, updating and implementation of statewide BST template-SOPs for ERIC-PCR, RiboPrinting, and *Bacteroidales* PCR along with coordination amongst other entities conducting BST in the state to standardize methodologies employed; (3) delivery of information and materials that give an overview of BST activities in Texas to date and describe the use, capabilities and applicability of BST and the services provided by the State-supported analytical labs to local, state and national stakeholder audiences; (4) continued development of the Texas *E. coli* BST Library; (5) further development of suitable source-specific bacteria markers for library independent BST; and (6) targeted BST.

Measures of Success (Expand from Summary Page)

- Updated BST template-SOPs for ERIC-PCR, RiboPrinting, and *Bacteroidales* PCR ensuring that template-SOPs include current methods, technologies and approaches.
- Maintain needed level of training of AgriLife SCSC and UTSPH EP personnel.
- Continued operation and maintenance of BST analytical equipment and support of personnel needs to sustain operating capability and expand the utilization of BST applications statewide.
- Targeted BST supporting watershed planning and implementation efforts in the Aransas River and Mission River watersheds
- Expansion of the Texas *E. coli* BST Library through the analysis of approximately 50 known source fecal samples collected by TWRI
- Development/evaluation of new source-specific bacterial markers for library-independent BST and evaluation of dPCR for quantitative detection of markers.
- Continued outreach through a BST state of the science website (http://texasbst.tamu.edu/) that serves as a repository for collected/produced BST information and source of BST related materials, updates, meeting announcements for educational opportunities
- Continued outreach through delivery of BST informational materials describing the state of the science, applicability, usefulness, and analytical capabilities of State-supported BST laboratories to water resource professionals across the state and nation

***2012 Texas NPS Management Program* Reference (Expand from Summary Page)**

Components, Goals, and Objectives
Component 1 – Explicit short- and long-term goals, objectives, and strategies that protect surface… water.
LTG 1 – Objective 1 – Focus … available resources in watersheds and aquifers identified as impacted by NPS pollution

LTG 1 – Objective 2 – Support the implementation of state, regional, and local programs to prevent NPS pollution through assessment…
LTG 1 – Objective 3 – Support the implementation of state, regional, and local programs to reduce NPS pollution, such as the implementation of strategies defined in TMDL I-Plans, [and] WPPs…
LTG 1 – Objective 6 – Develop partnerships … to facilitate collective, cooperative approaches to manage NPS pollution.
Short-Term Goal One – Data Collection and Assessment – Objective C – Conduct special studies to determine sources of NPS pollution and gain information to target… BMP implementation.
Component 2 – Working partnerships and linkages to appropriate State, interstate, Tribal, regional, and local entities, private sector groups, and Federal agencies.
Component 3 – Balanced approach that emphasizes both statewide NPS programs and on-the-ground management of individual watersheds.
Component 5 – …Progressively address these identified waters by conducting more detailed watershed assessments…
Estimated Load Reductions Expected (Only applicable to Implementation Project Type)
N/A

EPA State Categorical Program Grants – Workplan Essential Elements ***FY 2014-2018 EPA Strategic Plan* Reference**
Strategic Plan Goal – Goal 2 Protecting America's Waters
Strategic Plan Objective – Objective 2.2 Protect and Restore Watersheds and Aquatic Ecosystems

Part III – Financial Information

Budget Summary		
Category	**Costs**	
Personnel	$	114,855
Fringe Benefits	$	27,810
Travel	$	5,600
Equipment	$	0
Supplies	$	16,742
Contractual	$	141,069
Construction	$	0
Other	$	15,810
Total Direct Costs	$	321,886
Indirect Costs (≤15%)	$	48,283
Total Project Costs	$	370,169

Budget Justification		
Category	Total Amount	Justification
Personnel	$ 114,855	• TWRI PI (Gregory) $77,600 @ 0.5 months ($3,327) • SCSC PI (Gentry) $127,848 @ 2.1 months ($22,373) • TWRI Program Manager (TBD) $76,778 @ 1.5 months ($9,742) • TWRI Research Asst/Assoc. (TBD) $45,000 @ 2.17 months ($8,260) • SCSC Technician (Hux) $38,065 @ 14.01 months ($44,422) • SCSC Post Doc (Mukherjee, Boswell) $43,382 @ 6.675 months ($24,131) • SCSC Student Technician (Kocian) @ $10/hour for 260 hours ($2,600) *named positions are budgeted with a 3% annual pay increase in all years; TBD positions are budgeted with a 3% pay increase in years after year 1 *(Salary estimates are based on average monthly percent effort for the entire contract. Actual percent effort may vary more or less than estimated between months; but in the aggregate, will not exceed total effort estimates for the entire project.)
Fringe Benefits	$ 27,810	Fringe for Full Time Employees Calculated as: (Salary * 16.7% + $746/mo) *(Fringe benefits estimates are based on salary estimates listed. Actual fringe benefits will vary between months coinciding with percent effort variations; but in the aggregate, will not exceed the overall estimated total.)
Travel	$ 5,600	• TWRI travel to watersheds for fecal collection: 3 trips @ 700 mi ea. @ $0.50/mi: ($1,050) Per diem: 3 days @ $50/day: $150 • SCSC travel to project, state and national meetings ($4,400) Hotel: 11 days @ $91/day: $1,001 Per diem: 13 days @ $51/day: $663 Airfare: 4 trips est. at $448 ea.: $1,792 Rental Car: 11 days @ $35/day: $385 Rental Car Fuel: $150 Misc. Travel Fees: $409
Equipment	$ 0	N/A
Supplies	$ 16,742	• SCSC ERIC-RP supplies (150 * $53 = $7,950) • SCSC Marker Eval/Development Supplies ($3,000) • Miscellaneous project supplies ($1,857) • Fecal isolations: (25 * $25 = $625) • Fecal ERICs: (75 * $8 = $600) • Fecal RP: (38 * $45 = $1,710) • Misc. SCSC Lab Supplies: $1,000
Contractual*	$ 141,069	UTSPH EP
Construction	$ 0	N/A
Other	$ 15,810	• TWRI Communications Services ($2,984) • TWRI RiboPrinter Service ($6,500) • SCSC Conference Registrations ($600) • SCSC general maintenance on equipment ($1,100) • SCSC NELAP Lab accreditation fees ($1,010) • Sample Shipping Costs ($800) • SCSC Laboratory Refrigerator ($2,816)
Indirect	$ 48,283	15% of total direct costs ($321,886)

Contractual Budget Justification – UTSPH EP		
Category	Total Amount	Justification
Personnel	$ 75,590	• El Paso PI (Mena) $122,307: 0.35 months ($3,567) • El Paso PI (Rodriguez) $90,108: 0.5 months ($1,938) • El Paso Research Asst. (Truesdale) 14.4 months ($25,116) • El Paso Research Asst. (Monserrat) 10.32 months ($24,244) • El Paso Research Assoc. (Casarez) 7.8 months ($20,725)
Fringe Benefits	$ 15,985	• El Paso PI (Mena) 27% of personnel ($963) • El Paso Research Asst. (Monserrat) 40% of personnel (+ longevity) ($9,698) • El Paso PI (Rodriguez) $717 • El Paso Research Assoc. (Truesdale) $4,607
Travel	$ 2,000	Trip to College Station for research collaboration (will include hotel, lodging, rental car, rental car fuel, airfare and per diem)
Equipment	$ 0	N/A
Supplies	$ 27,094	• Fecal sample *E. coli* isolations: 25 @ $25 ea. = $625 • *E. coli* isolation from water samples (2 sites for 12 months, 5 isolates/ sample = 120 isolates @ $8 ea.) = $960 • ERIC-RP supplies ($8*138 isolates ERIC, $45*97 isolates RP) = $5,468 • Library independent BST marker supplies = $1,550 • Library independent animal virus supplies = $2,000 • Applied Maths Software = $8,269 • El Paso RiboPrinter Service = $6,500 • Additional Supplies = $1,722
Contractual*	$ 0	N/A
Construction	$ 0	N/A
Other	$ 2,000	• Refrigerator and general maintenance (Biological Safety Cabinets, freezers and refrigerators) = $2,000
Indirect	$ 18,400	15% of Total Direct Costs